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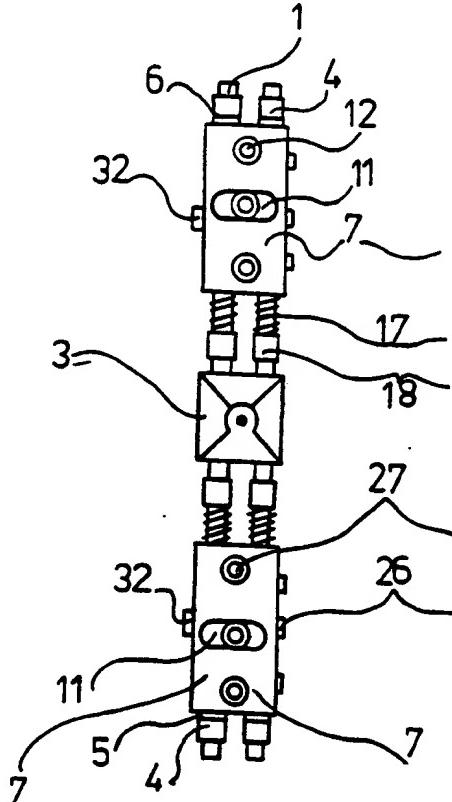
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(54) Title: A STABILIZER FOR TREATING BROKEN BONES

(57) Abstract

A stabilizer for treating broken bones constitutes a dynamic fixator for treatment of fractures in the neighbourhood of various bone joints. The stabilizer is constructed of a proximal assembly consisting of the connector (7) shiftable on rails (1, 2) by adjustment means (18) via spring elements (17). The rails (1, 2) are connected with the stabilizer joint (3) whose axis is coincident with the joint to be spanned. In the connector (7) there are formed openings for bone screws (14, 15, 16), introduced to the bones at right angles or at any other angle required for increased stability. Reposition is enabled by lateral shifting of bone screw (15) in oval opening (11) by means of adjusting screw (32). The distal assembly may be the same as the proximal assembly, or may take various forms depending on the joint to be spanned.



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A STABILIZER FOR TREATING BROKEN BONES

Field of the Invention

The present invention concerns an external stabilizer for treatment of broken bones, especially joint bones.

Background of the Invention

There are known the external stabilizers for treatment of bone breaks, equipped with bone screws, stabilizing rails and controlling - stabilizing mechanismus. The examples are stabilizers known from filing specifications RP nr P 280389, P 283664 and P 285201. Such stabilizers enable the reposition of bone stumps in axial lift and their stabilization. Such stabilizers have however disadvantages, namely large overall dimensions impossibility of full reposition and a lack of satisfying stabilization.

The Iliazarow's stabilizers assure good stabilization and reposition of bone stumps, however they have large overall dimensions and due to a lack of movable joint they can not be used for treatment based on functional method.

20 Summary of the Invention

The object of the invention is to elaborate the stabilizing set - up, enabling the correlation of displacements, stabilization of bone stumps and functional treatment in motion, with possibility of accomodation the elements of said set - up corresponding to a kind of bone break. The stabilizer consists of an assembly of guiding rail and connector with bone screws, what constitutes the

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prior-to-joint assembly. It has a possibility of adjusting the position of rails in relation to connector and of bone screws in relation to connector. The prior-to-joint assembly is connected by a movable joint with an out-of-joint assembly, which depending on the location constitutes symmetrically the same out-of-joint construction or a specific construction intended for treatment of broken elbow or ankle joint. For treatment of broken shaft of bones there is applied the stabilizer, composed of prior-of-joint assembly, having joint part replaced with the openings for bone screws.

These and further objects, features and advantages of the present invention will become apparent from the following detailed description, wherein reference is made to 15 the figures in the accompanying drawings.

Brief Description of the Drawings

Fig. 1 shows schematically a longitudinal cross - section of the device;

Fig. 2 shows the device in a side cross - section;

20 Fig. 3 is a front view of the connector with bone screws;

Fig. 4 is a longitudinal cross - section of prior-to-joint assembly with closed section;

Fig. 5 is a side view of the assembly as seen from 25 Figure 4;

Fig. 6 is a cross - section of the assembly from Figure 4;

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Fig. 7 is a cross - section of the prior-to-joint assembly having a C - shaped section;

Fig. 8 is an element semi - circular in cross - section;

5 Fig. 9 is a side view of the element of Fig. 8;

Fig. 10 is a side view of out-of-joint ankle assembly;

Fig. 11 is a transverse cross - section of the assembly of Fig. 10;

10 Fig. 12 is a transverse cross - section of out-of-joint elbow assembly;

Fig. 13 is a longitudinal cross - section of the assembly of Fig. 12;

Fig. 14 is a side view of the assembly of Fig. 12;

15 Fig. 15 is a longitudinal cross - section of the stabilizer for treating the shaft of long bones; and

Fig. 16 is a side view of the stabilizer.

Detailed Description of Preferred Embodiments

The stabilizer consists of prior-to-joint assembly
20 as shown of Fig. 1 - 3 and composed advantageously of two
guide rails 1, 2 having preferably a circular cross - section,
- on which there is embedded a longitudinal connector
7, having a possibility of axial movement. Said movement
is generated by adjustment means 18, preferably in the form
25 of a nut, directly or by means of elastic elements 17, e.g.
springs. On the other side of connector 7 there are means
4 for limiting movement, preferably in the form of nuts,

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threaded into quiding rails. Preferably between the means
4 for limiting movement and the connector 7 there are placed
the damping elements, eg. of rubber /not shown/. Between
one connector 7 and the second connector there are
5 the quiding rails 1, 2 connected with a mechanical joint 3
having a characteristic approaching the human joint on
which it is installed. In the connector 7 there are formed
the apartures having the shape and the size approaching
the quiding rails 1, 2. Angularly to them, and preferably
10 at the straight angle, there are the openings 12, in which
the bone screws 14, 15, 16 are fixed. One of bone screws 15
is shifted transversely in transverse oval orifice 11, what
enables its displacement in relation to an axis of the
assembly, as well as compensation of bone stumps displace-
15 ments.

The shifting of said bone screw is realized by means
of adjusting screw 32. The blocking of bone screws takes
place by means of blocking screws 26 or bolts 27.

In order to obtain the larger stiffness and strength
20 of the assembly, especially in treatment of lower limb,
advantageously there is applied the assembly as shown in
Figs. 4 - 7, in which the connector 7 is places shiftably
between external guide rails 1, 2 having a shape approach-
ing the C - shaped rail 28 /Fig. 7/ or preferably having
25 the closed cross - section rail 29 /Fig. 6/. The axial
shifting is generated by the rotation of a tightening screw
30. The rails 28 or 29 are connected with the joint 3 by
means of a ball joint 33 a blocking serew 34.

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For the treatment of broken bones in the space of metacarpus, metatarsus and fingers there is advantageous to incorporate the bone screws together with stabilizing assembly at the angle of about 45° in relation to bending

5 axis of the joint. The axes of human joint and mechanical joint have to be simultaneously coextensive. It is realized by means of two semi - circular elements 21, constituting the axial joint. Said elements have the shape approaching the sections of rings.

10 For the treatment of elbow joint there is applied the stabilizer as shown in Figs. 12 - 14. It consists of a typical prior-to-joint assembly /not shown/, connected by means of an axial joint with the out-of-joint assembly, formed of an arcuately bent element 35, the proximal end 15 thereof constituting the part of stabilizer's joint, and the second wide end has apertures for screws 40, 41. Said screws enter the openings 37, 38 of a plate 36 and enable its shifting. Unscrewing said screws enables the reposition of the break, and the blocking makes the reposition 20 durable. At the end of the plate 36 there is placed a rotatable rod 39 having transverse openings 43, 44 in which there are embedded the bone screws, blocked by means of a nut 42.

For the treatment of ankle joint there is applied 25 stabilizer as shown in Figs. 10 and 11. It consists of prior-to-joint assembly /not shown/, connected by means of an axial joint with out-of-joint assembly, constructed of a connector 45, constituting at one end the part of the

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joint, and at the other end constituting the leading for a quide 46. On its ends there are shiftably placed the elements 47, having the openings for the bone screws. All elements are blocked by means of the bolts.

5 For treatment of broken shaft of long legs there may be used the stabilizer as shown in Figs. 15 and 16. Said stabilizer is constructed from a connector 48 having a controller means 50, bone screws 48 and a part of quiding rails constituting an prior-to-joint assembly. The quiding
10 rails are connected inseparably with element 52, being equipped with bone screws.

While the device described herein before is effectively adapted to fulfill the aforesaid object, it is to be understood that the invention is not intended to be limited to the specific preferred embodiment. Rather, it is
15 to be taken as including all reasonable equivalents within the scope of the following claims.

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We claim:

1. A compensating stabilizer for treating the broken bones, especially at the space of joints, being constructed of quiding rails, having places thereon the connectors with bone screws, and of movable joint, characterized in that the prior-to-joint assembly is preferably composed of two parallel quiding rails /1/, /2/, on which rails there are placed two movement limiting means /3/, /4/ contacting advantageously of means of buffer pads /5/, /6/ with a connector /7/ shiftable on rails, having the bone screws /14/ /15/ /16/ and stabilized by spring means /17/ and controlling means /18/ on said quiding rails /1/ /2/ being connected with a joint /33/, controlling - stabilizing assembly.

15 2. The stabilizer according to Claim 1, wherein the connector /7/ comprises longitudinal quides /25/ for said quide rails /1/ /2/, having a profile corresponding to them and parts /12/ perpendicular to a long axis, for appropriate amount of bone screws /14/ /15/ /16/, blocked 20 by means of blocking screws /26/ or bolts /27/, one of said bone screws being guided transversely in an oval opening /11/ and being adjusted by means of an adjusting screw /32/.

3. The stabilizer according to Claim 1, wherein the connector /7/ is shiftable in external quide rails 25 having a cross - section approaching the shape of C-channel /28/ or having a closed cross - section, preferably oval /29/, by means of a tightening screw /30/, and said quiding rail is connected with the movable joint by means of

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the joint /33/, preferably being the ball joint, and of blocking screw /34/.

4. The stabilizer according to Claim 1, wherein the bone screws are inclined at the angle of about 45° to 5 the bending axis of treated human joint, and the prior-to-joint and out-of-joint assemblies are connected with two semi - circular elements /21/, forming the axial joint.

5. The stabilizer according to Claim 1, wherein the prior-to-joint assembly is connected by means of axial 10 joint with the out-of-joint assembly, comprised of bent element /35/ connected shiftably with a plate /36/ by means of screws /40/ /41/ in openings /37/ /38/, said plate having on its end a rod /39/, disposed rotatably and shiftably thereon and having transverse openings /43/ /44/ for 15 bone screws being stabilized in the rod by means of a nut /42/.

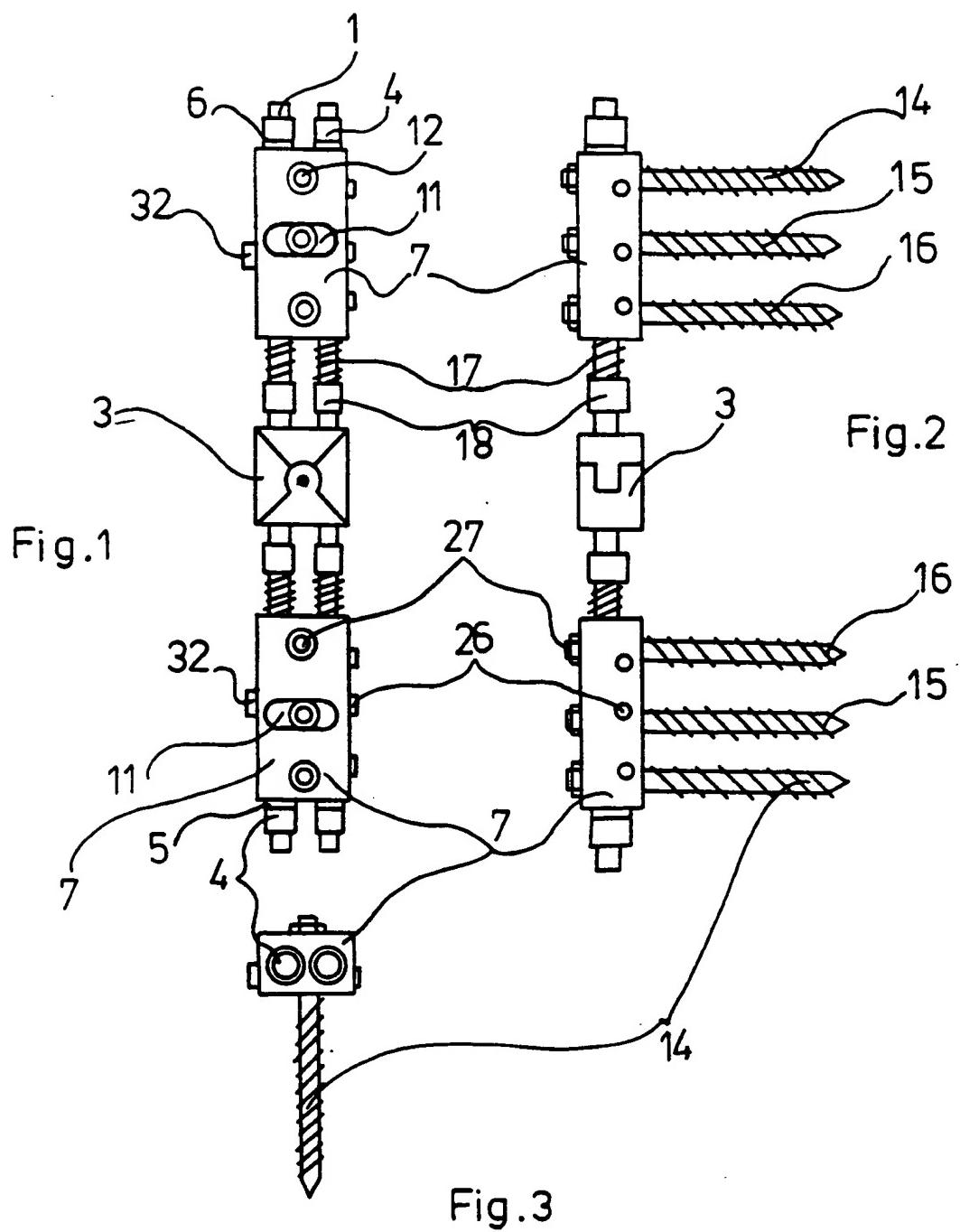
6. The stabilizer according to Claim 1, wherein the prior-to-joint assembly is connected by means the axial joint with the out-of-joint assembly, constructed of 20 the connector /45/, in which there is disposed shiftably a quide /46/, at the ends of which there are placed the elements /47/ having the openings for bone screws.

7. The stabilizer according to Claim 1, wherein the connector /48/ with the controlling means /50/ and 25 bone screws /51/ and with a part of quiding rails constitute the prior-to-joint assembly, and the rails connecting with the element /52/ having the openings for the bone screws constitute the out-of-joint assembly.

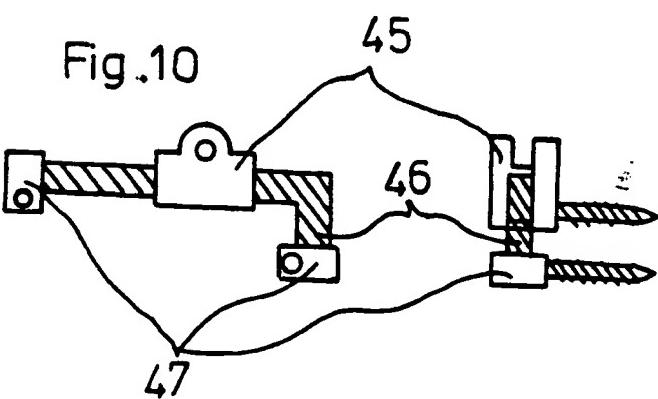
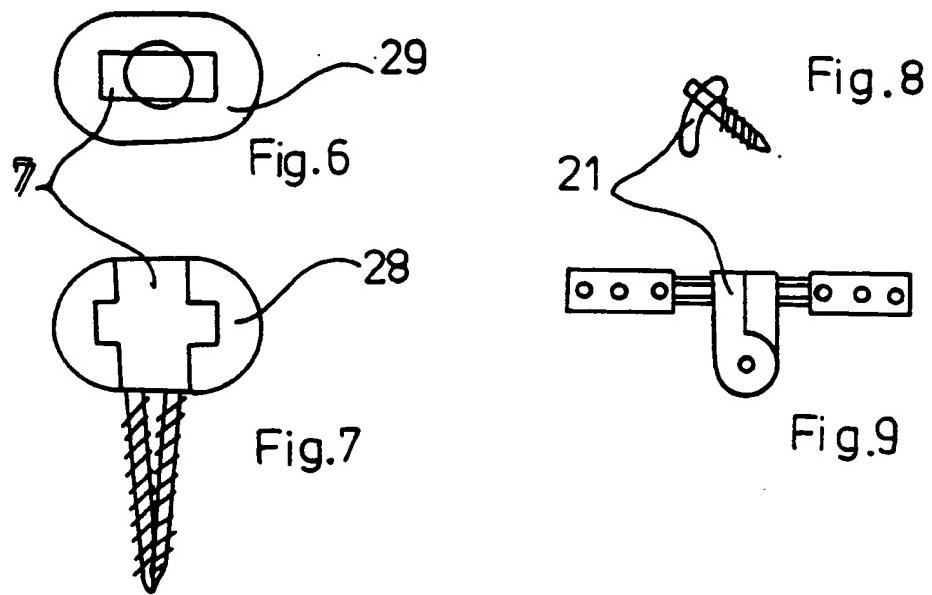
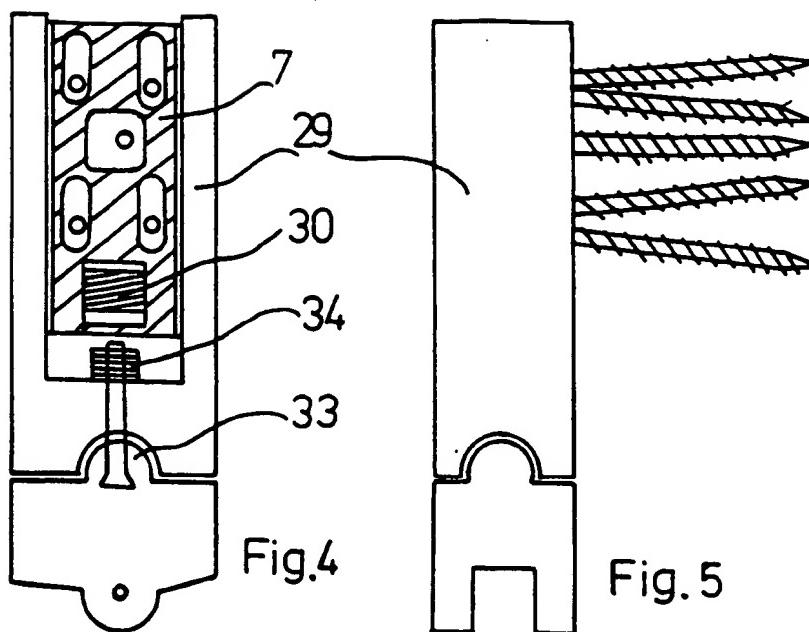
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8. The stabilizer according to Claim 1, wherein the bone screws extend through the connector at various angles.



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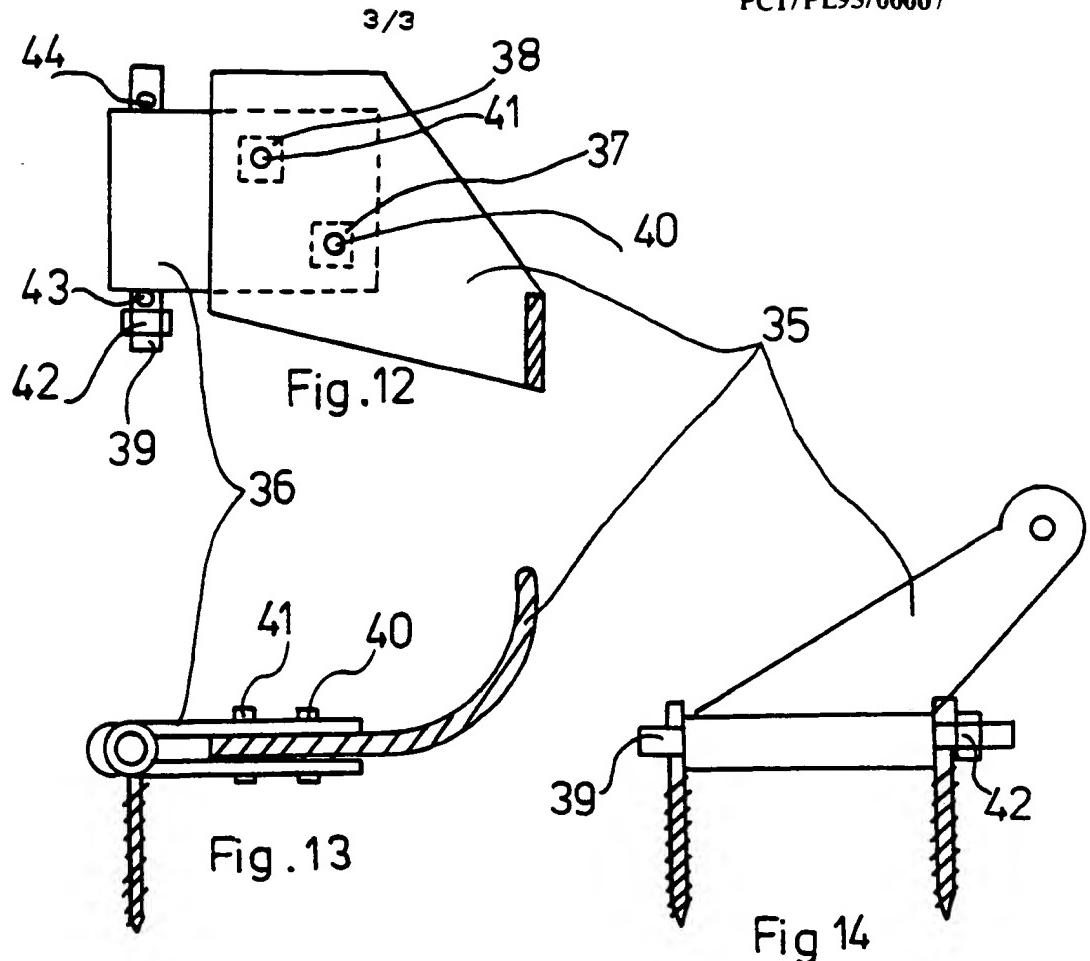


Fig.15

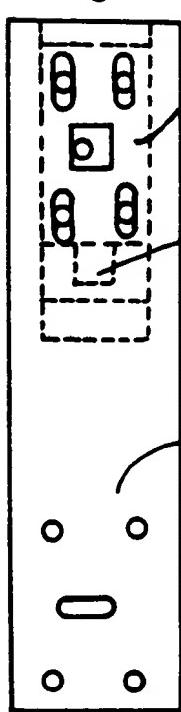
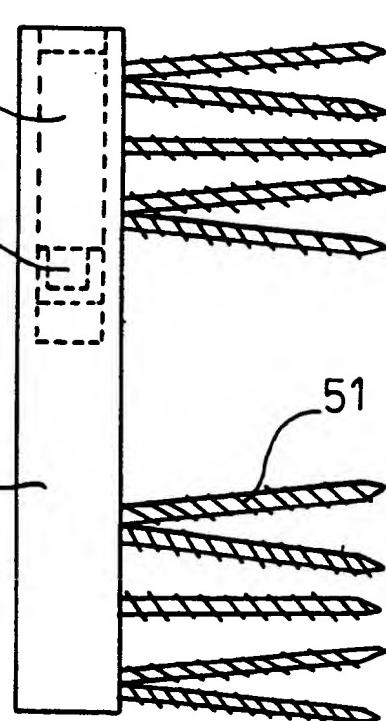


Fig.16



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/PL 93/00007

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)⁶

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.C1. 5 A61B17/60

II. FIELDS SEARCHED

Minimum Documentation Searched⁷

Classification System	Classification Symbols
Int.C1. 5	A61B

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched⁸III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US,A,4 730 608 (A.P.SCHLEIN) 15 March 1988 see figure 7 ---	1
A	FR,A,2 129 735 (P.RINIKER) 27 October 1972 see page 1, line 29 - page 2, line 14 see figure 2 ---	1
A	DE,A,3 527 342 (AESCALAP-WERKE) 12 February 1987 see abstract see column 4, line 66 - column 5, line 25 see figure 1 ---	1
A	EP,A,0 240 034 (U.WITZEL) 7 October 1987 see figure 1 ---	1-2,8 -/-

⁶ Special categories of cited documents :¹⁰

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document not published on or after the international filing date
- "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "A" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

11 AUGUST 1993

Date of Mailing of this International Search Report

24.08.93

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

NICE P.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 458 486 (J.B.RICHARDSON) 27 November 1991 see figure 3	4

INTERNATIONAL SEARCH REPORT

INTERNATIONAL APPLICATION NO.

PCT/PL 93/00007

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 7 because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claim 7 describes the embodiment illustrated in figs. 15-16. This does not possess a "movable joint" (component (3)), and is therefore inconsistent with independent claim 1, on which claim 7 is dependent.

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
 No protest accompanied the payment of additional search fees.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

PL 9300007
SA 74924

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11/08/93

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4730608	15-03-88	None		
FR-A-2129735	27-10-72	CH-A- 536107 DE-A, B, C 2203787 GB-A- 1374511 US-A- 3727610		30-04-73 28-09-72 20-11-74 17-04-73
DE-A-3527342	12-02-87	None		
EP-A-0240034	07-10-87	DE-A- 3611319 DE-A- 3775958 WO-A- 9312729 US-A- 4920959		15-10-87 27-02-92 08-07-93 01-05-90
EP-A-0458486	27-11-91	None		